SANTA CLARA COUNTY
FLOOD CONTROL AND WATER DISTRICT

Geology and Cost Estimate
LITTLE ARTHUR CREEK DAMSITE INVESTIGATION

prepared for the

South Santa Clara Valley Water Conservation District

Report prepared by the

WATER SUPPLY PLANNING DIVISION

April 1972

San Jose, California

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GEOLOGIC INVESTIGATION AND PRELIMINARY COST ESTIMATE
FOR THE
LITTLE ARTHUR CREEK DAMSITE
ON
LITTLE ARTHUR CREEK
SANTA CLARA COUNTY, CALIFORNIA

Foreword

At the request of and funded by the South Santa Clara Valley Water Conservation District, the Santa Clara County Flood Control and Water District has undertaken a geologic investigation and a preliminary cost estimate of a proposed dam on Little Arthur Creek. The cost estimate is based on a preliminary design of a dam and is subject to refinement in a more detailed study. However, within the scope of this study the estimate of cost may be considered adequate for planning purposes only.

A design constraint desired by the South Santa Clara Valley Water Conservation District and included in this study is that for purposes of economy Redwood Retreat Road (Sanders Road) was not to be relocated.

It should be noted that if the proposed Gilroy Dam on the Uvas[1] were built, the reservoir pool would inundate all but about the top 20 feet of the Little Arthur Dam. This was not a consideration of this report due to the uncertain status of the Gilroy Dam Project.

---

[1] Reference U. S. Army Corps of Engineers, May 1965 "Flood Control and Allied Purposes for Pajaro River Basin, Santa Clara, Santa Cruz and Monterey Counties, California." Progress Report.

This report also contains the results of hydrology studies previously done along with the area elevation and area capacity curves. These curves were obtained from a small scale map and therefore are approximate only.

The geologic investigation revealed no adverse conditions that would prevent siting a dam at the location shown in Figure 1. This location was previously called Site 3 in the progress report of December 1970. The preliminary cost estimate to construct the dam, spillway, outlet works and other appurtenances as well as to clear the reservoir area and to purchase the land is:

Clearing	$ 80,000
Construction	1,401,900
Sub-total	1,481,900
Misc. & Cont. (30%)	444,600
Total Construction Cost	$1,926,500
Land	550,000
Grand Total	$2,476,500

Plates 1 through 3, bound at the back of this report, give the general layout and details of the dam and appurtenances as conceived for this study.

GEOLOGY OF THE LITTLE ARTHUR CREEK DAMSITE

Introduction

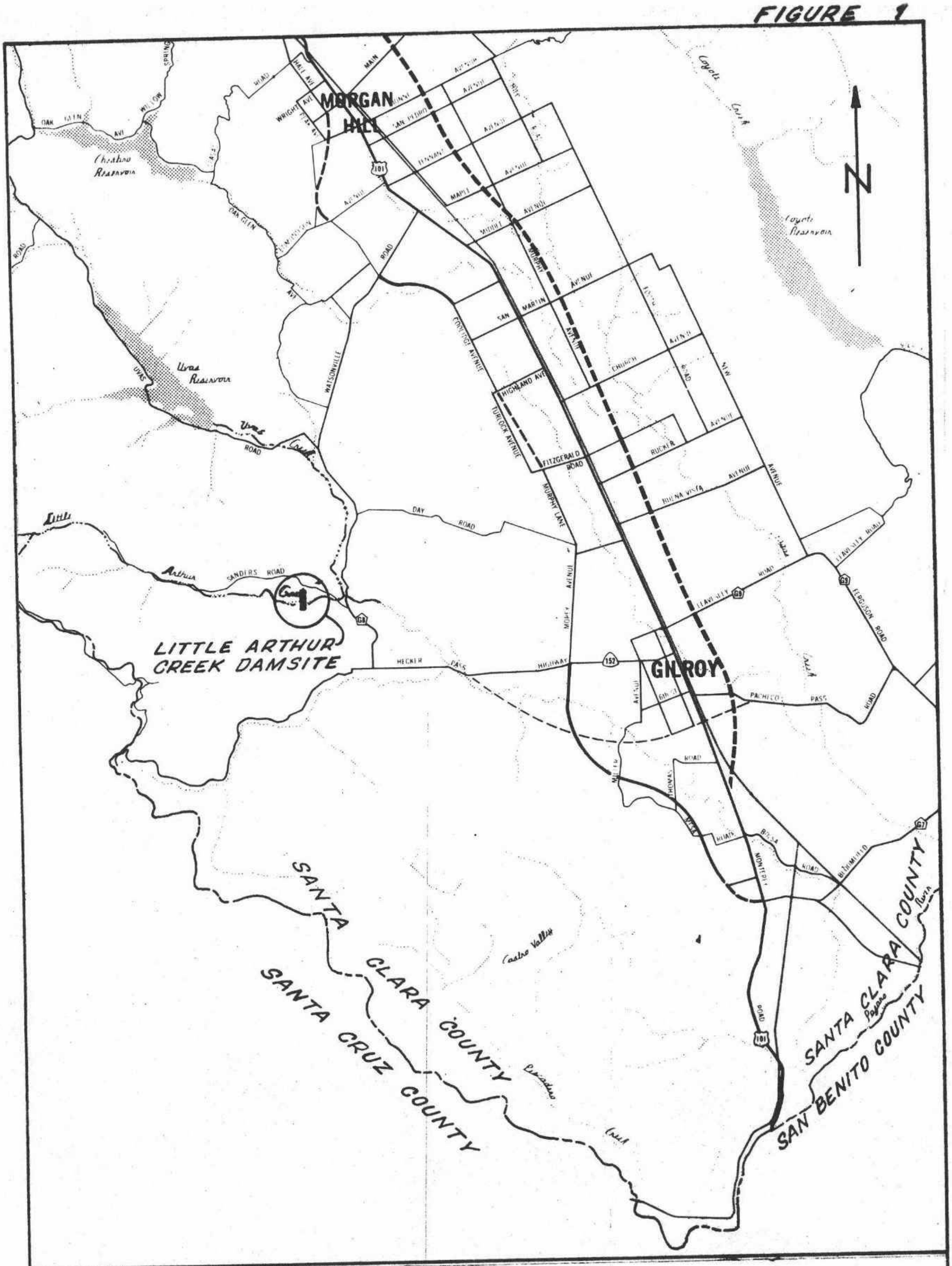
At the request of the South Santa Clara Valley Water Conservation District, the Santa Clara County Flood Control and Water District reviewed several possible reservoir locations on Little Arthur Creek. After reviewing the Progress Report of December, 1970, the Board of Directors of the South Valley District selected Alternative Axis 3 to be considered for further studies. This report discusses the engineering geology of that axis.

Location and Description of the Project

The Little Arthur Creek damsite as shown on Figure 1 is located 5 airline miles west of Gilroy on Little Arthur Creek, a tributary of Uvas Creek. As shown on Figure 2, the damsite axis straddles the middle of the projected section line that would divide Sections 29 and 32, T. 10S., R. 3E., M.D.B. and M. This is about one-half mile upstream from the confluence into Uvas Creek. Access to site can be attained by driving one-half mile west on the Redwood Retreat Road (or Sanders Road) from Watsonville Road.

The proposed dam is to have a crest elevation about 380 feet above sea level. The reservoir would have a storage

FIGURE 1



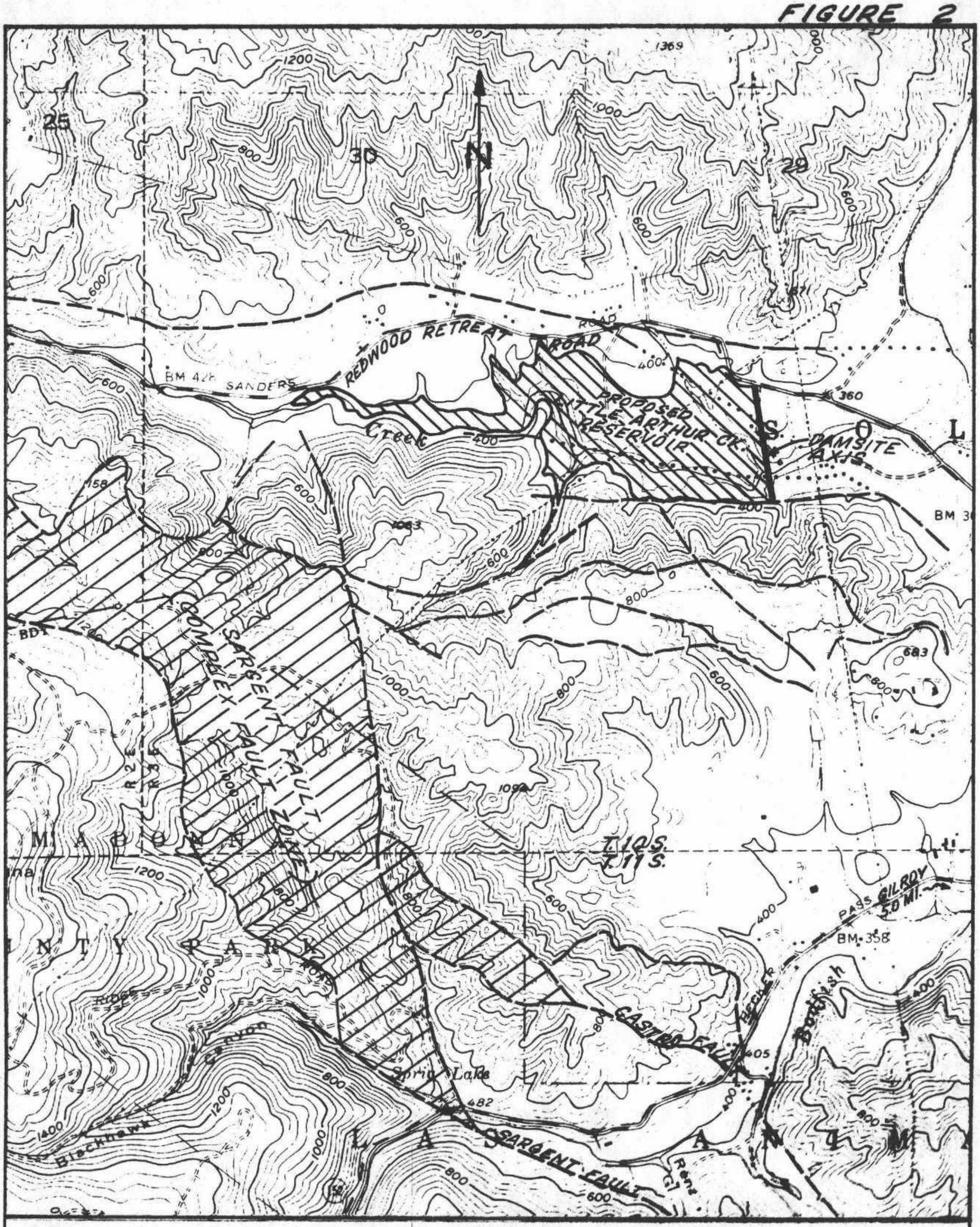
LOCATION MAP

LITTLE ARTHUR CREEK DAMSITE

April 1972

Scale: 1" = 2 mi.

FIGURE 2



Notes:
1. Faulting pattern is in part after U. S. Geological Survey and California Division of Mines and Geology.
2. Faults are dotted where concealed by alluvium.
3. Base map is portion of U.S.G.S. Mt. Madonna Quadrangle, 7-1/2 minutes. 1955.

LOCATION MAP AND REGIONAL FAULTING PATTERN

LITTLE ARTHUR CREEK DAMSITE

April 1972

Scale 1" = 1,000; C.I.=40'

capacity of about 2,400 acre-feet and would be contained by a proposed homogeneous earthfill dam about 80 feet high above the stream bed and about one-third mile long along its crest.

Purpose and Scope

The purpose of the geologic study was to perform a preliminary evaluation of the foundation conditions for the dam and appurtenances and to locate and evaluate the potential sources of naturally occurring construction materials in the nearby area for the proposed dam. The investigation consisted of geologic mapping, drilling of two foundation holes to depths of 50 and 52.5 feet, laboratory soils testing of samples, and two seismic surveys along the left abutment axis. No drilling was performed in the potential borrow areas. The geologic exploration performed is considered advanced reconnaissance in scope.

Previous Studies

Potential damsites on Little Arthur Creek within the vicinity of the present axis were inspected on a reconnaissance basis on September 29, 1970, and on October 15, 1970, by Thomas Iwamura. Field notes on these reconnaissances were compiled.

Two of the more recently published regional geologic maps that cover the damsite area are:

1. California State Division of Mines, 1966, "Geologic Map of California, San Jose Sheet." Scale 1:250,000.

2. McLaughlin, Robert J., 1971, "Geologic Map of the Sargent Fault Zone in the Vicinity of Mount Madonna, Santa Clara County, California." San Francisco Bay Region Environment and Resources Planning Study, Basic Data Contribution 13, U. S. Geological Survey. Scale 1:12,000.

Regional Geology

The proposed Little Arthur Creek damsite is located in a small mountain valley on the east slope of the Santa Cruz Mountains, 5 airline miles west of Gilroy. The Santa Cruz Mountains in the vicinity of the damsite are underlain by highly deformed sedimentary and metamorphic rocks of the Jurassic-Cretaceous age Franciscan Formation and by folded sequences of sedimentary rocks, principally sandstone, of Tertiary age (in previous reports the sandstone was thought to be Cretaceous in age). Both of these rock units are intersected by both active and inactive faults. Rocks of the Franciscan Formation had been intruded by serpentine, generally in association with faults. Landslides are common on the hillsides underlain by the Franciscan Formation rocks.

Seismicity

The dam and reservoir sites are cut by several faults, all of which are considered to be inactive. The regional faulting pattern of the area is presented on Figure 2. The presence of these faults is not expected to present any unusual problems for the construction of the proposed project. However, with the active, northwesterly trending San Andreas fault passing 4 miles to the southwest and the Calaveras fault passing 9 miles to the northeast, the damsite should be considered to be located in a very seismically active area. Another large fault, the Sargent fault, passes 1-1/2 miles southwest of the damsite. This fault also trends northwesterly and also is considered to be active. Five known epicenters of earthquakes ranging in magnitude from 4.0 to 5.4 on the Richter scale have been noted within 5 miles of the damsite (California State Department of Water Resources, January 1964, "Bulletin No. 116-2, Crustal Strain and Fault Movement Investigation").

Geology of the Site

The damsite section is formed by a relatively steep right abutment, a broad U-shaped entrenched channel section which makes a short right angle turn along the axis, and by a broad, gently sloping compounded terrace (several terrace levels) on the left abutment. A tributary stream entrenched into the left abutment terrace joins Little Arthur Creek just downstream of the damsite axis. Detailed topography and the areal geology of the damsite are presented on Figure 3.

The damsite was geologically mapped by Santa Clara County Flood Control and Water District geologist on October 1, 1970, and the subsurface exploration was performed by Lowney-Kaldveer Associates on March 9, 1972. The subsurface exploration data developed are presented in Lowney-Kaldveer's report to the

Santa Clara County Flood Control and Water District, "Subsurface Exploration and Laboratory Testing Program, Little Arthur Creek Damsite" dated March 21, 1972. The locations of the two exploration drill holes and the two seismic survey lines are also shown on Figure 3. Geologic cross sections of the site are presented as Figures 4 and 5.

The width of the valley at the damsite is formed by the floodplain of Little Arthur Creek, upon which was deposited a thick section of alluvial terrace deposits on the bedrock surface. The bedrock consists of Tertiary sandstone and Franciscan Formation sedimentary rocks. Since the build up of the terrace deposits, the narrow channel of Little Arthur Creek has cut through a portion of the terrace deposits so as to expose the bedrock formations along the stream channel. Hence, the present damsite section is underlain by bedrock formations in the channel and lower abutments while the upper abutments are underlain by terrace deposits. The uppermost right abutment is underlain by Franciscan Formation bedrock exposed above the old floodplain.

An old fault trending east-west cuts through the bedrock units along the stream channel at the damsite. This fault is normal to the damsite axis and forms the contact between the Franciscan Formation on the south and the Tertiary sandstone formation on the north.

LEGEND
Qal Stream Channel Alluvium
Loose Sand and Gravel, Unsorted
Qt Terrace Deposits
Unconsolidated Sand and Gravel, with Silt and Clay
Ts Tertiary Sandstone
Massive, Hard To Friable, Weathers To Silty Sand
JKf Franciscan Formation
Contorted and Sheared Sandstone, Shale, and Chert. May be Intruded by Small Bodies of Serpentine at Damsite.
SYMBOLS
Geologic Contact, Appoximate Location
U D Fault, Appoximate Location, U=Up, D=Down
? D Fault, Inferred
Fault, Concealed by Alluvium or Terrace Deposits
EB-1 Drill Hole Location
SP-1 SP-2 Seismic Survey Line Location, SP=Shot Point
B-1 Surface Soil Sample Location
A A' Location of Geologic Section
Damsite Axis, Tentative Location
N
Sanders Road
Redwood Retreat Road
Little Arthur Creek
Damsite Axis
Line 1
Line 2
SP-1
SP-2
SP-3
SP-4
EB-1
EB-2
B-1
A
A'
B
B'
Dense Trees
Qt
Qal
Ts
JKf
+301.2
+299.6
+337.6
+340.2
+340.6
+347.0
+344.4
+346.8
+349.2
+351.2
+363.2
300
310
320
330
340
350
360
370
380
390
400
410
420
430
440
450

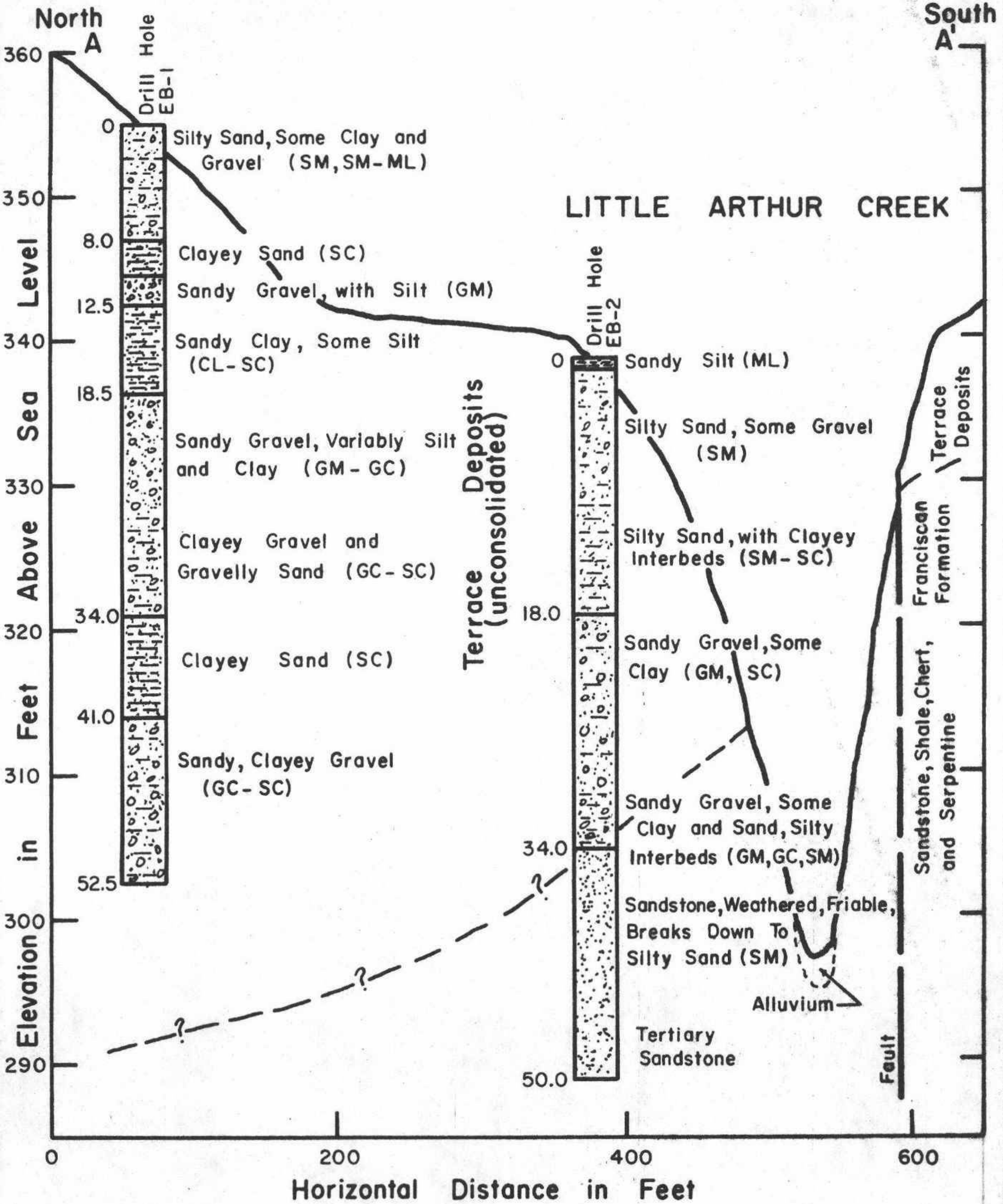
NOTE

Refer To Figures 4 and 5 for Geologic Sections

GEOLOGIC MAP
LITTLE ARTHUR
CREEK DAMSITE

April 1972

Scale 1"=100'   C.I.=2' and 10'

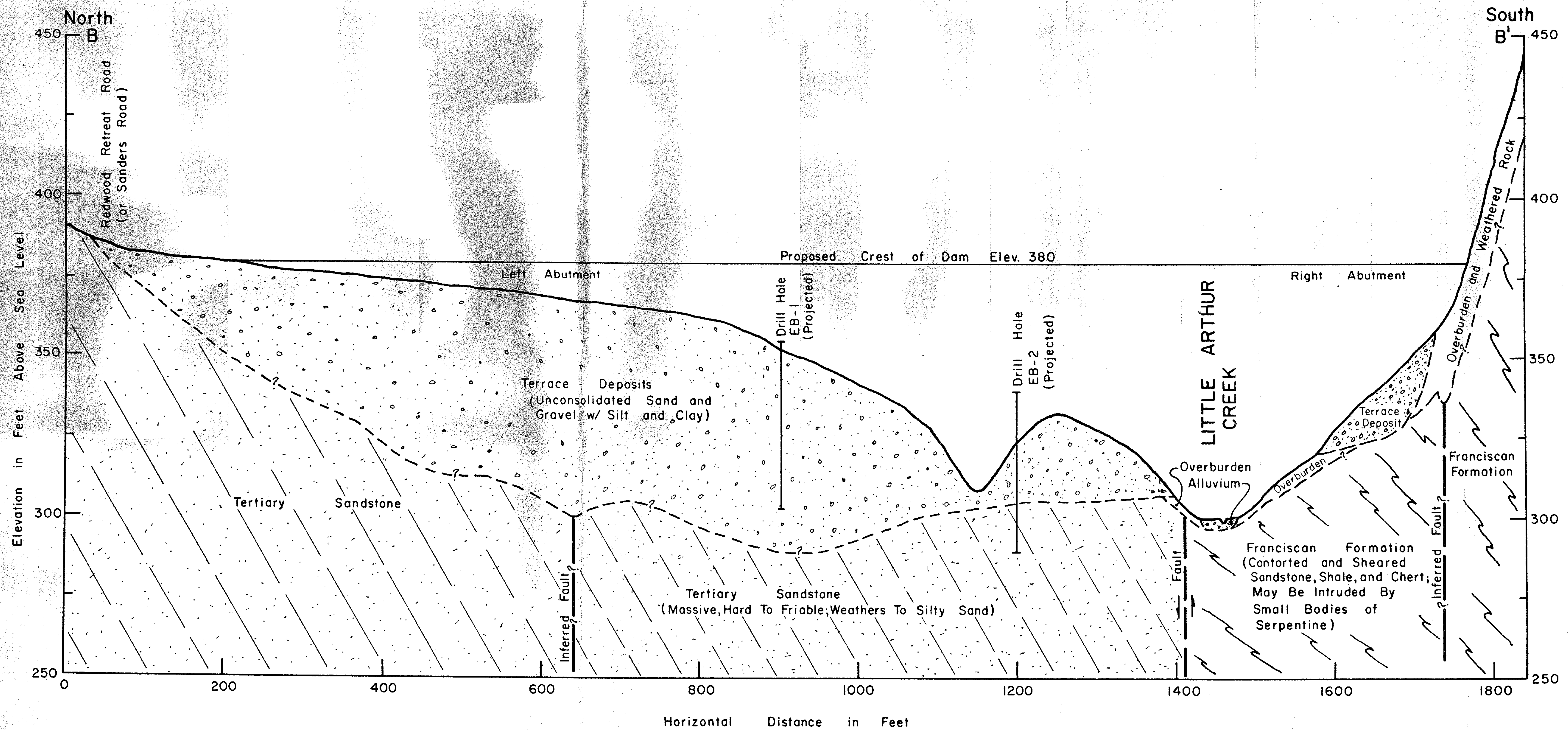

North
A
South
A'
Drill Hole EB-1
Drill Hole EB-2
Elevation in Feet Above Sea Level
360
350
340
330
320
310
300
290
0
8.0
12.5
18.5
34.0
41.0
52.5
Silty Sand, Some Clay and Gravel (SM, SM-ML)
Clayey Sand (SC)
Sandy Gravel, with Silt (GM)
Sandy Clay, Some Silt (CL-SC)
Sandy Gravel, Variably Silt and Clay (GM-GC)
Clayey Gravel and Gravelly Sand (GC-SC)
Clayey Sand (SC)
Sandy, Clayey Gravel (GC-SC)
LITTLE ARTHUR CREEK
Terrace Deposits (unconsolidated)
0
18.0
34.0
50.0
Sandy Silt (ML)
Silty Sand, Some Gravel (SM)
Silty Sand, with Clayey Interbeds (SM-SC)
Sandy Gravel, Some Clay (GM, SC)
Sandy Gravel, Some Clay and Sand, Silty Interbeds (GM, GC, SM)
Sandstone, Weathered, Friable, Breaks Down To Silty Sand (SM)
Tertiary Sandstone
?
?
?
Alluvium
Terrace Deposits
Franciscan Formation
Sandstone, Shale, Chert, and Serpentine
Fault
0
200
400
600
Horizontal Distance in Feet

Note: Refer To Figure 3 For Location of Section

SECTION A-A
LITTLE ARTHUR CREEK DAMSITE

April 1972

Figure 5


North
B
South
B'
450
400
350
300
250
Elevation in Feet Above Sea Level
Redwood Retreat Road (or Sanders Road)
Proposed Crest of Dam Elev. 380
Left Abutment
Right Abutment
Drill Hole EB-1 (Projected)
Drill Hole EB-2 (Projected)
LITTLE ARTHUR CREEK
Terrace Deposits (Unconsolidated Sand and Gravel w/ Silt and Clay)
Tertiary Sandstone
Tertiary Sandstone (Massive, Hard To Friable; Weathers To Silty Sand)
Inferred Fault
Fault
Overburden
Alluvium
Overburden
Terrace Deposit
Overburden and Weathered Rock
Franciscan Formation
Franciscan Formation (Contorted and Sheared Sandstone, Shale, and Chert; May Be Intruded By Small Bodies of Serpentine)
Inferred Fault
?
0
200
400
600
800
1000
1200
1400
1600
1800
Horizontal Distance in Feet

Note:

1. Refer To Figure 3 For Location of Section.
2. Section is Interpretative as Based on Surface Mapping, Two Exploration Drill Holes and Two Seismic Survey Lines, and is in Part Diagramatic.

SECTION B-B'
LITTLE ARTHUR CREEK DAMSITE

April 1972

A fault is suspected to occur in the Franciscan Formation bedrock high up the right abutment concealed beneath the terrace deposits. Its suspected occurrence is based on topography and expressions on aerial photographs. This fault is suspected to be parallel to the previously mentioned fault. Another fault is suspected to occur in the bedrock cutting northwesterly through the middle of the left abutment and is concealed beneath the terrace deposits at the damsite. The presence of this fault was based on surface geologic mapping in the nearby area and on seismic survey data.

Right Abutment

The upper portion of the right abutment is formed by a moderately narrow ridge outlined by a minor ephemeral stream tributary on the downstream side and by an ancient stream terrace on the higher elevation portion of the upstream side. As this abutment ridge descends, it is outlined by the bend of the stream on the upstream side. Subsurface exploration was not performed on this abutment and the geologic section shown on Figure 5 of the abutment was based on soil types on the surface. The maximum depth of terrace deposits, which occurs on the middle of the abutment, is estimated to be about 25 feet. The Franciscan Formation bedrock which outcrops above and below and which underlies the terrace deposits is suspected to be deeply weathered to estimated depths of 20 feet on the upper abutment and 5 feet on the lower abutment. The unweathered Franciscan Formation bedrock is expected to vary from hard, where little disturbed, to compacted, where it is sheared and contorted.

Estimated stripping depth on the right abutment is 5 feet normal to the slope to remove the soil within the root zone. By placing the axis of the dam just upstream of the right abutment ridge, a deep cutoff will not be required.

A vegetative cover on the abutment consists of moderately thick timber and heavy brush.

Channel Section

As shown on Figure 3, the stream channel makes a right angle turn at the base of the right abutment ridge and then parallels the damsite for 300 feet before resuming its east-west course. The southern portion of the channel section is underlain by Franciscan sandstone, shales, and some chert while the northern portion is underlain by Tertiary sandstone. The two formations are separated by a fault trending normal to the damsite axis. Bedrock outcroppings along the channel are few and discontinuous due to the thin covering of channel sand and gravel deposits and due to the overburden soil cover as the section rises above the streambed. The Tertiary sandstone is massive and varies in hardness from very hard where it is cemented to compacted and friable where it is uncemented or slightly weathered.

Estimated stripping requirement would entail the removal of the shallow stream channel deposits and soil cover and the shaping of the section which would average less than 5 feet normal to the surface. Cutoff for the dam would be formed by the entrenched channel section itself as it parallels the damsite axis.

Vegetative cover in the channel consists of light timber and moderate to heavy brush.

Left Abutment

The left abutment is formed by a broad, flat terrace with several levels and is cut by a single entrenched ephemeral tributary which joins the stream just downstream of the damsite axis (the juncture would lie beneath the dam embankment). The terraces are underlain by terrace deposits which are in turn underlain by Tertiary sandstone which intersects the surface in the lower portion of the abutment and along portions of the stream channel. As noted in the stream channel section, individual rock outcroppings of Tertiary sandstone on the lower abutment are few and discontinuous.

The drilling and seismic survey explorations indicated the terrace deposits to be relatively thick, perhaps about 70 feet as shown in Figures 4 and 5. As indicated by the exploration drill holes, the terrace deposits consist of silty sand, sandy clay, sandy clayey gravel and sandy gravel with variable silt and clay content. Possible reservoir seepage could occur through some of the more permeable layers in this unit. The Tertiary sandstone beneath the terrace deposits appears to be massive and is lightly cemented to compacted and friable. It breaks down to a brown silty sand with some clay. This bedrock unit is expected to be sufficiently impermeable as not to cause leakage problems.

Minor perched groundwater zone was noted in the terrace deposit at the contact with the massive sandstone. This was noted at a depth of 34 feet in exploration drill hole EB-2 (Figures 3 and 4). In drill hole EB-1, groundwater was encountered at a depth of 30 feet.

Estimated stripping requirement would entail the removal of the grassy sod cover and the root zone of the fruit orchard and vineyard. This may average about 3 to 4 feet of stripping normal to the slope. In the lower portion of the abutment section which would be subjected to higher reservoir head, the cutoff would have to extend through the terrace deposits to the top of the Tertiary sandstone unit. The actual depth of the cutoff excavation could be greatly reduced by placing the cutoff in the entrenched tributary which trends along the abutment at a small angle to the damsite axis (refer to Figures 3 and 5). As the floor of the reservoir rises up the abutment, only a partial cutoff will be required due to the lower reservoir head.

The left abutment is essentially cleared except for the vineyards on the lower abutment, the fruit orchard on the upper abutment, and dense brush and light trees along the entrenched tributary channel.

Outlet Works

An outlet pipe buried in an excavated trench along the stream channel or lower abutments could adequately serve as an outlet pipe. This structure would have to be curved beneath the dam embankment to conform to the topography along the stream. Depth to adequately sound bedrock is expected to be shallow, perhaps from 5 to 10 feet below original ground surface.

Spillway

A side channel spillway around either abutment appears to be feasible. Topography favors the left abutment where a smaller cut would be required. The left abutment spillway would be founded on the terrace deposits which should provide an adequate foundation for the structure. A moderately deep cutoff will be required at its upper end and the entire channel would have to be lined due to the erosiveness of the soft terrace deposits.

A spillway around the right abutment would require a large cut due to the steepness of the slope above the abutment. The upper portion would be founded on weathered Franciscan Formation rocks and the reentry channel would be cut through the terrace deposits. Due to the suspected deep weathering of the Franciscan Formation on the upper abutment, the spillway channel would have to be lined and the cut slope would have to be laid back conservatively, perhaps around 1:1 or flatter. The topography of the spillway chute through the terrace will be less steep but lining will still be required.

The reentry point, common to a spillway around either abutment, would be located about 600-700 feet downstream of the dam. A stilling pool or other means to dissipate the flow energy will be required to prevent excessive erosion at the reentry.

Reservoir Site

Due to the asymetrical section of the valley with the deepest portions of the reservoir on the south side, that side of the reservoir would be relatively steep. The large expanse of the northern side would have a very low grade descending down the wide terraces that occur on that side.

Rocks that underlie the reservoir are principally terrace deposits with Franciscan Formation and Tertiary sandstone along the stream channel and upper south side of the reservoir. Reservoir leakage is not expected except for a potentially small amount beneath the shallow left abutment of the dam where cutoff would not extend to bedrock. Siltation potential is expected to be moderate due to the weathered nature of the rocks and the presence of landslides in the drainage area. There are no potentials for a large slide which could avalanche into the reservoir, although numerous small scale soil creep and minor sliding conditions could be induced on the steeper southern side of the reservoir. The latter is not expected to present any serious reservoir operation problems.

Much of the proposed reservoir area is currently used for farming. Fruit orchards and vineyards are planted on the terraces. Several residences currently occupy the site. No road would have to be relocated. A few towers of a southwesterly trending power line would have to be relocated.

Clearing of the reservoir would entail the removal of the vineyards and orchards on the terraces and the profuse brush growth and light timber on the right abutment side and along the stream and tributary channels. Fewer than 10 small buildings (houses, barns, sheds) occur within the reservoir site. Only two of the houses are permanently occupied.

Construction Materials

Impervious

A vast quantity of terrace deposits occur in the reservoir that could be used as impervious fill for the proposed 365,000 cubic yard homogenous section earthfill dam. The materials consist of silty sand (SM), clayey sand (SC), and sandy gravel with silt and clay (GM-GC). Mechanical analysis of bank sample B-1 was classified as a well graded gravel (GW) and is expected to be semi-permeable when compacted. However, the mixing and compacting of the overall terrace deposits section is expected to be sufficiently impermeable for the proposed dam. The sample location of B-1 is shown on Figure 3.

It is expected that the Tertiary sandstone beneath the terrace deposits is also suitable for impervious fill. The friable sandstone would break down to a silty sand or silty sand with some clay (SM).

As indicated by the exploration drill holes on the left abutment terrace, the depth of useable materials is great and the borrow sites would be adjacent to the damsite. Stripping would entail the removal of the grassy sod cover and the root zone of the orchards and vineyards.

Riprap

No large suitable source of riprap material could be located near the site. One possible source was inspected 3/4 mile upstream of the dam site axis. This potential source is a massive cemented sandstone outcropping (Tertiary), through which the stream has cut a narrow notch. A small concrete dam about 30 feet high was constructed in this notch many years ago and this dam is still in use. The quality of this rock would have to be proven.

Another possible source of riprap is the commercial granite quarry located near Chittenden Pass in Santa Cruz County, 8 air-line miles south of the damsite.

The use of soil-cement may be an alternative for riprapping the upstream face of the dam.

Sand and Gravel

Sand and gravel for filter material and aggregate appear to be limited in volume near the site. The most economical source may be from commercial sources along Uvas Creek near Gilroy, within 5 miles of the damsite.

COST ESTIMATE AND HYDROLOGY
OF THE
LITTLE ARTHUR DAMSITE

Cost Estimate

In order to better evaluate the costs likely to be incurred in the construction of the Little Arthur Creek dam, mapping of the damsite by aerial photography was accomplished. The design of the dam itself was based on the results of the geologic investigation and general dam construction practices. A detailed engineering design was beyond the scope of this study.

Plates 1 through 3 at the back of this report present the configuration and general details of the project as contemplated in this report. A brief description of each of the main features of the dam and appurtenances follows.

Dam

The dam consists of a homogenous earthfill structure utilizing natural material at the site. The dam contains about 360,000 cubic yards of material, has a crest length of about 1700 feet and is about 80 feet high above the stream channel at its maximum. (Ref. Plate 2). The reservoir would have a storage capacity of about 2400 acre feet at the spillway crest elevation of 372 feet.

The material for the dam will come from two locations. The first is an area behind the left abutment which when excavated will also provide an approach channel to the spillway. The second is an area immediately upstream of the damsite lying between the main channel and a tributary. The upstream face of the dam has a slope of 3.5 to 1 and is armored with an 8-foot-wide blanket of soil-cement. The downstream face is on a slope of 2.5 to 1 and contains a blanket filter under the toe of the dam. The dam has a top width of 25 feet. An average of 4 feet of stripping under the base of the dam was considered.

The axis of the dam is so located that the existing main channel and tributary, essentially parallel to the dam axis, may be utilized as a cutoff trench thus minimizing cutoff trench excavation.

Outlet Works

The outlet works consist of a vertical, trash rack protected, inlet shaft located on the right abutment outside of the dam fill and founded in rock. The shaft is equipped with a horizontal, hydraulically operated, slide gate (Ref. Plate 3).

A 36-inch concrete encased and mortar lined steel pipe, founded in bedrock, leads to a valve house and impact type energy dissipator downstream of the dam. The downstream valve was considered to be of the manually operated butterfly type.

Spillway

The spillway is composed of an Ogee type weir (crest elevation 372 feet), a vertical sided flume and a USBR Type II energy dissipator. The weir has a length of 120 feet with a central 4-foot-wide pier to support the access road bridge. A portion of the hillside along Redwood Retreat Road was considered excavated to provide fill material and an approach channel to the spillway (Ref. Plate 2).

The spillway was designed to carry 6000 cfs and has 2.5 feet of freeboard at that flow. The crest of the dam was placed as high as it could be without requiring road relocation and the spillway crest was made as long as seemed reasonable to get it as high as possible in order to maximize reservoir storage. This produced the 2.5 feet of freeboard. Future studies of a more detailed nature will be needed to evaluate the economics of a higher dam or longer spillway in order to obtain more storage, involving in the process road relocation, more dam fill, increased freeboard and a more expensive spillway.

The spillway configuration, as it appears in this report, seems somewhat expensive in light of the size of the dam and reservoir. This particular configuration was chosen because the various components are tried and proven performers. They can be designed with a minimum of engineering time, providing, a realistic design for cost estimating purposes. Other possible locations for a spillway have not been investigated other than in the most cursory manner due to the absence of specific geologic data. A side channel spillway was the only alternative investigated and was rejected because it is not recommended to found them on anything but bedrock due to vibrations.

Cost Estimate

A breakdown of the quantities and costs for the dam is contained in Table 1.

Hydrology

Flood Frequency Curve

Only a very preliminary hydrologic study has been done. The flood peak frequency curve has been calculated by the Flood Control District's standard regional frequency method and is shown in Figure 6. Briefly, this method utilizes significant parameters of the watershed itself and its mean annual rainfall combined into equations developed from gaged watersheds in the District. The equations, when solved, provide the statistical parameters needed to construct the frequency curve for peak flood flows. Flood hydrographs were not developed. The records from the existing stream gage on Little Arthur Creek at Redwood Retreat Road were not utilized because of their very short period of record. The gage has been yielding good records

TABLE 1 ESTIMATED COST OF LITTLE ARTHUR CREEK DAM

(1972 Costs)

Item	Unit	Quantity	Unit Price	Item Cost	Total Cost
EARTH EMBANKMENT & RESERVOIR					
Stripping under the dam	cu yd.	54000	$ 1.40	$ 75,600	
Clearing reservoir area	Acres	80	1000.	80,000	
Rolled fill embankment	cu yd.	296000	1.	296,000	
Soil cement facing	cu yd.	71000	3.	213,000	
Blanket filter under the dam	cu yd.	3330	3.50	11,660	
					$ 676,260
SPILLWAY					
Chute floor	cu yd.	5200	80.	416,000	
Side walls & headwalls	cu yd.	860	150.	129,000	
Filter & bedding under chute	cu yd.	7210	3.80	27,400	
Riprap downstream	cu yd.	1200	18.	21,600	
Bridge over the spillway	sq ft.	3250	20.	65,000	
					$ 659,000
INTAKE STRUCTURE					
(i) Structure excavation and backfill	cu yd.	164	8.10	1,330	
(ii) Reinforced concrete	cu yd.	42	150.	6,300	

TABLE 1 ESTIMATED COST OF LITTLE ARTHUR CREEK DAM

(1972 Costs)

Item	Unit	Quantity	Unit Price	Item Cost	Total Cost
INTAKE STRUCTURE (Cont.)					
(iii) Trash rack	L.S.		$ 7000.	$ 7,000	
(iv) Heavy-duty slide gate for 36" dia. opening (seating head up to 100 ft., unseating head up to 30 ft.)	L.S.		5000.	5,000	
(v) Hydraulic cylinder & piping for operating the slide gate	L.S.		5000.	5,000	
					$ 24,630
OUTLET PIPE					
(i) Excavation and backfill in creek bed to expose firm foundation or bedrock for laying of pipe	cu yd.	3245	8.10	26,280	
(ii) 36" dia. steel pipe CM lined	L.F.	600	40.	24,000	
(iii) Concrete jacketing around pipeline	cu yd.	260	100.	26,000	
(iv) Vertical & horizontal bends	Number	5	1000/ea.	5,000	$ 81,280

TABLE 1 ESTIMATED COST OF LITTLE ARTHUR CREEK DAM

(1972 Costs)

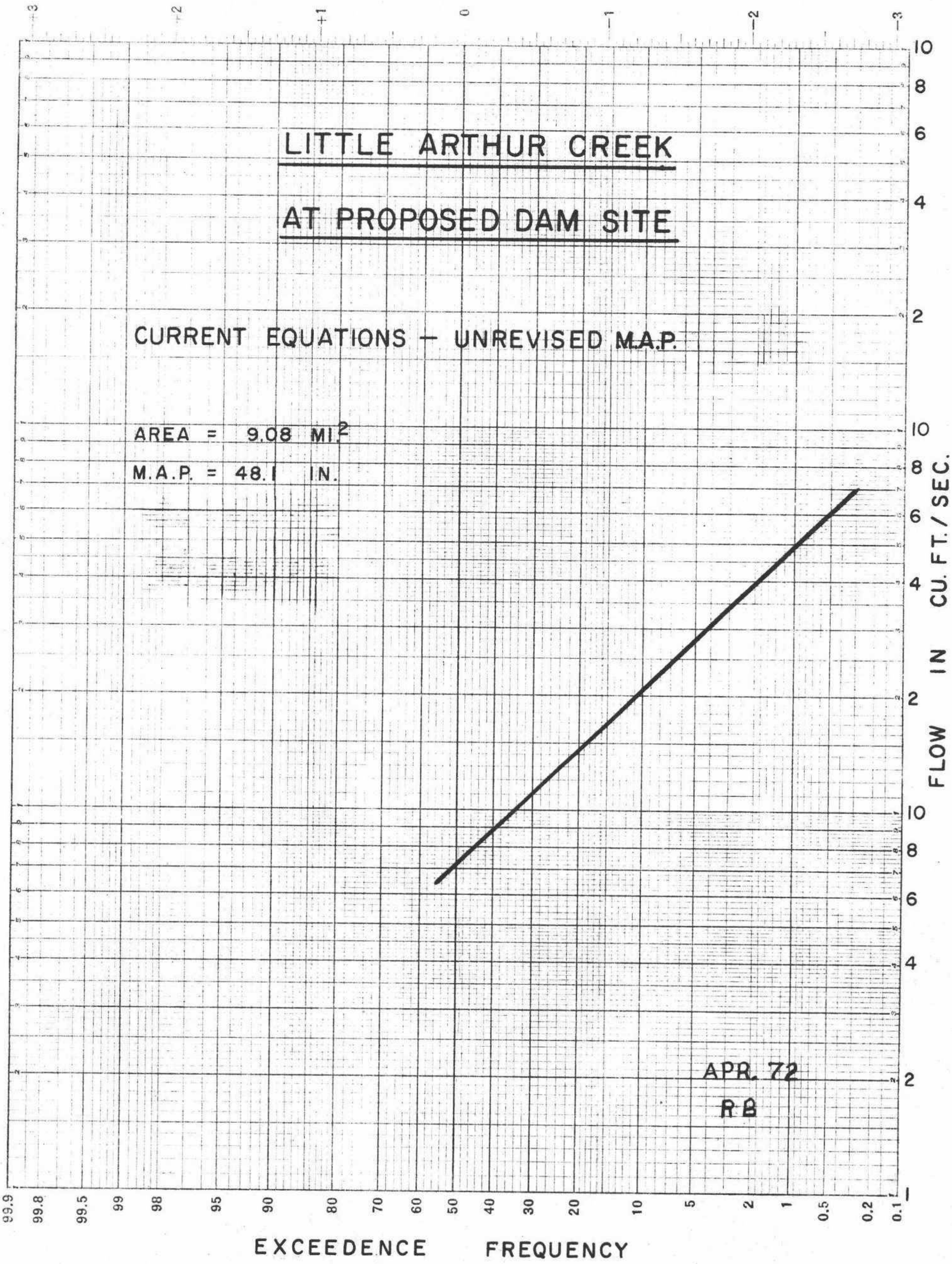
Item	Unit	Quantity	Unit Price	Item Cost	Total Cost
OUTLET STRUCTURE					
(i) Structure excavation & backfill (impact chamber)	cu yd.	88	$ 8.10	$ 710	
(ii) Channel excavation	cu yd.	70	1.00	70	
(iii) Reinforced concrete in					
(a) Impact type stilling basin	cu yd.	14	150.	2,100	
(b) Valve house	cu yd.	9	150.	1,350	
(iv) Butterfly valve (36")	ea.	1	20000.	20,000	
(v) 18" rock riprap	cu yd.	28	18.	500	
					$ 24,730
MISCELLANEOUS					
Service road from top of the dam to the downstream valve house	Miles	0.25	40000.	10,000	
Relocate power line	L.S.		6000.	6,000	
					$ 16,000

TABLE 1 ESTIMATED COST OF LITTLE ARTHUR CREEK DAM

(1972 Costs)

Item	Unit	Quantity	Unit Price	Item Cost	Total Cost
				SUB TOTAL	$1,481,900
				MISC. & CONTINGENCIES AT 30%	444,600
				TOTAL CONSTRUCTION COST	1,926,500
COST OF LAND PURCHASE AND RELOCATIONS	Acres	100	$ 5500.	$ 550,000	550,000
				GRAND TOTAL	$2,476,500

FIG. 6



LITTLE ARTHUR CREEK

AT PROPOSED DAM SITE

CURRENT EQUATIONS – UNREVISED M.A.P.

AREA = 9.08 MI^2

M.A.P. = 48.1 IN.

APR. 72

RB

NO. 31-378 LOGARITHMIC NORMAL. CODEX BOOK CO. INC. NORWOOD MASS. 02062

only since about 1965.

Detailed studies currently underway by the Flood Control District of the mean annual rainfall at various locations in Santa Clara County indicate that the mean annual rainfall utilized to construct the flood frequency curve for Little Arthur Creek will significantly decrease. This may result in a reduction of the design flood flows below those shown on Figure 6.

Reservoir Yield Analysis

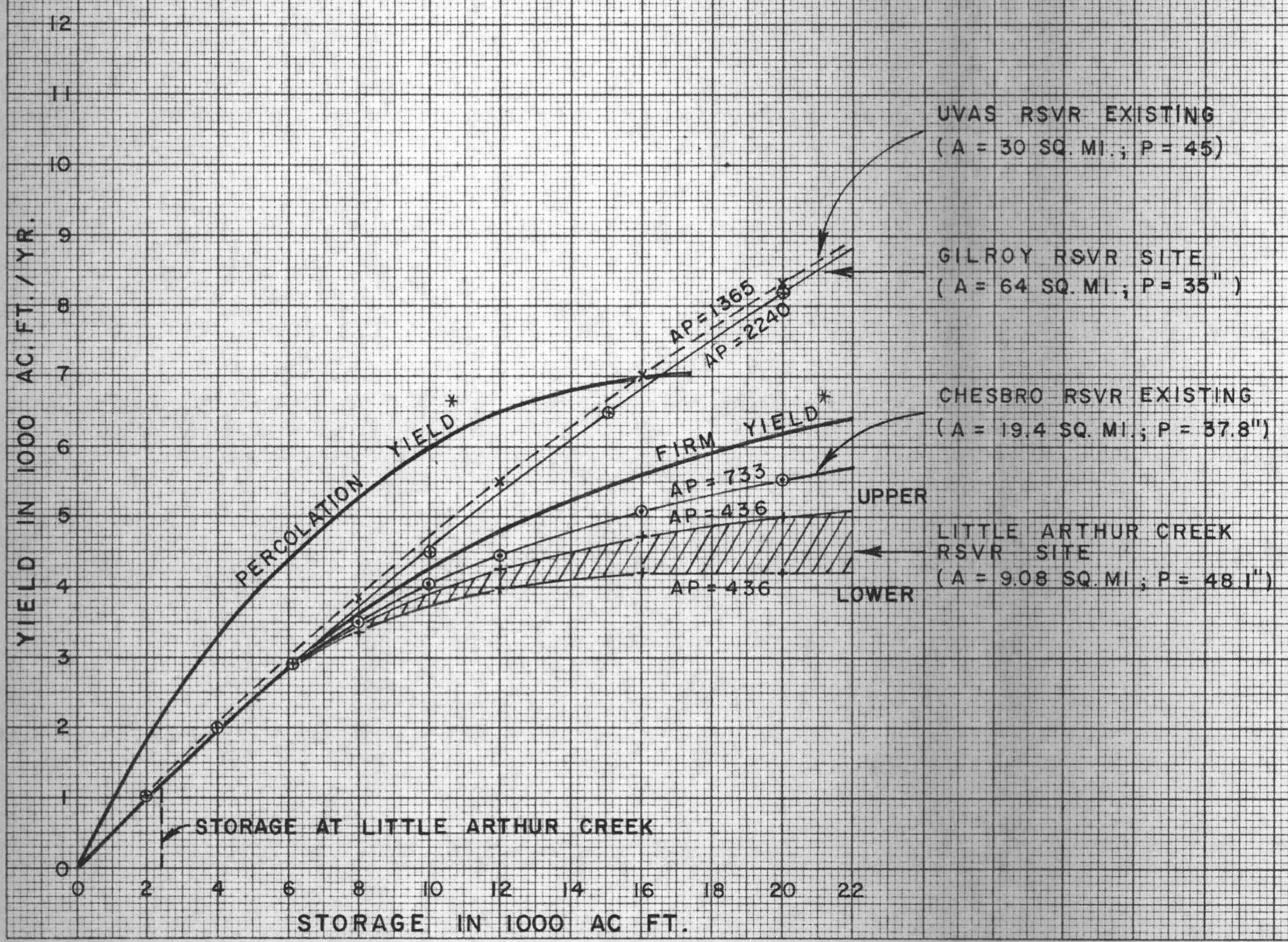
Figure 7 is a diagram of yields vs. reservoir capacity which was developed in October 1970 for the contemplated Little Arthur Creek reservoir site. It reflects the results of very approximate computations with reference to previous studies of a similar purpose by the District's Water Supply Division or by the Corps of Engineers.

A first approach consisted in plotting previously developed storage-yield curves for the Gilroy Reservoir site and the existing Uvas and Chesbro Reservoirs. This approach related differences in the product of drainage area and mean annual precipitation between Chesbro Reservoir and the other two respectively. On the same basis two curves were obtained, designated upper and lower, encompassing a range of conceivably possible values at the Little Arthur site.

FIGURE 7

STORAGE - YIELD CURVES FOR KNOWN A-P FOR DIFFERENT RESERVOIR SITES

A = DRAINAGE AREA AT THE DAM SITE (SQ. MI.)
P = MEAN ANNUAL PRECIPITATION OVER THE WATERSHED (INCH)



LEGEND

⊗ GILROY RSVR
× UVAS RSVR (EXIST)
⊙ CHESBRO RSVR (EXIST)
+ LITTLE ARTHUR CK. RSVR

*BASED ON CORPS OF ENGINEERS YIELD STUDY FOR CORRALITOS CK. DAM SITE

LITTLE ARTHUR CREEK
DAM SITE

DATE 10-26-70
APM

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Then, a comparison was made with a Corps of Engineers yield study for the Corrallitos Creek damsite on the basis of mean annual runoff as a fraction of the mean annual precipitation (M.A.P.). Two curves were derived, for what the Corps considers "firm yield" (with storage carryover to successive years) and "percolation yield" (all water stored during the wet season released for percolation during the following dry season).

For storage capacities of less than 6000 to 7000 AF, the so-called "firm yield" curve and the others, except the percolation yield curve, seem to more or less coincide. Percolation yield as determined by this study for a reservoir capacity of about 2400 acre feet would be about 2100 acre feet per year.

It must again be emphasized that the yields obtained are very preliminary and for study purposes only.

Figure 8 is the reservoir area elevation and elevation capacity curves developed by earlier studies. These curves were determined from USGS 7.5 minute quads and thus should be considered very preliminary in nature.

Summary and Conclusions

Geologic Investigation

1. As based on an advanced reconnaissance geologic investigation which included a limited subsurface exploration (on the

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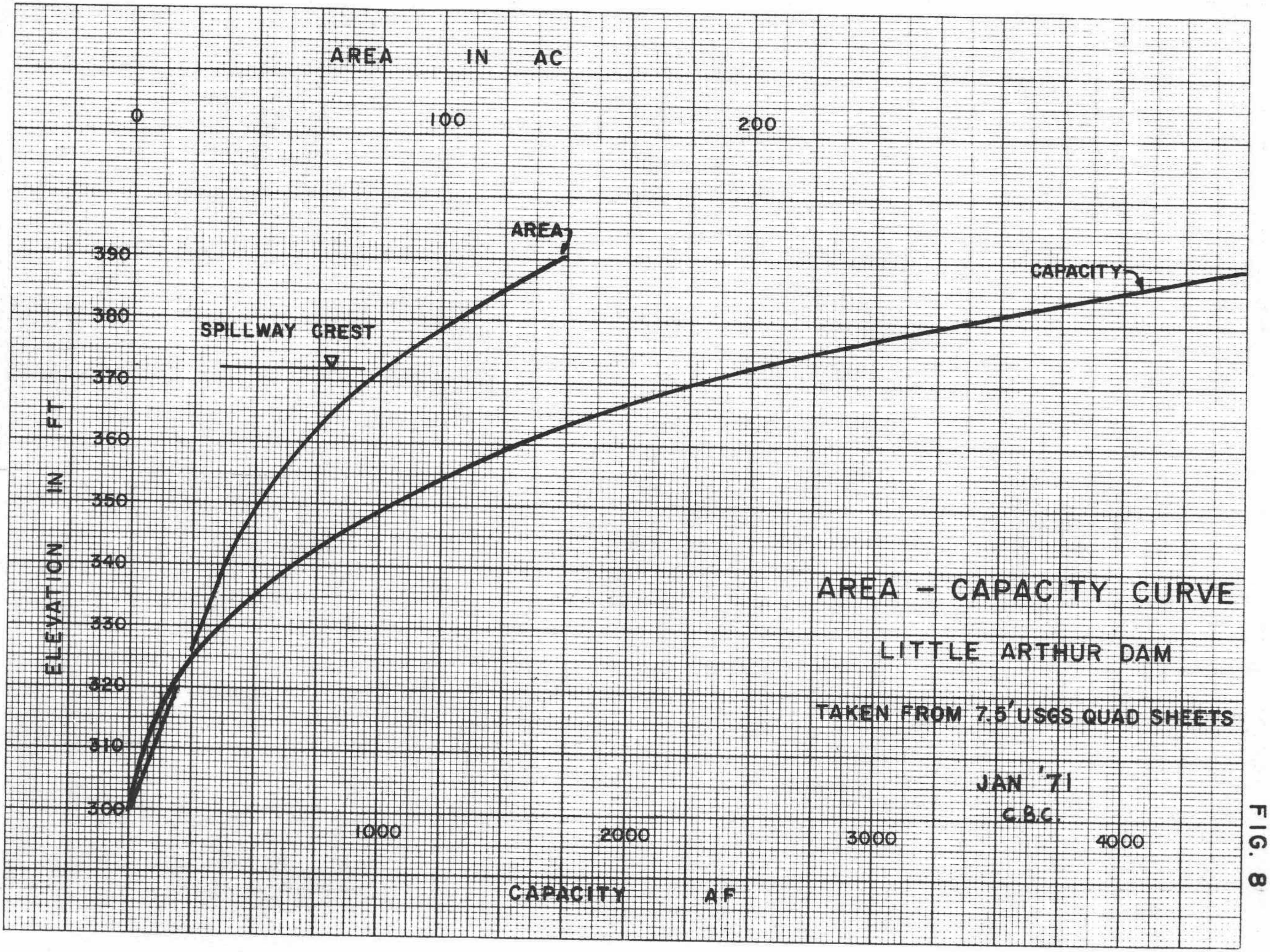


AREA - CAPACITY CURVE

LITTLE ARTHUR DAM

TAKEN FROM 7.5' USGS QUAD SHEETS

JAN '71
C.B.C.

FIG. 8

left abutment), the proposed Little Arthur Creek damsite appears to be suitable for the construction of the proposed 360,000 cubic yard, 80-foot high, homogenous section earthfill dam.

2. Since the regional area of the damsite is considered to be seismically active, the dam embankment slopes would have to be designed conservatively.

3. The foundation rocks, consisting of unconsolidated, alluvial terrace deposits on the abutments and the Teritary sandstone and Franciscan Formation units which occur in the channel section and lower abutments and which underlie the terrace deposits, should provide an adequate foundation for the proposed dam. Zones within the terrace deposits may be pervious, and hence, a positive cutoff extending to bedrock will be required through this unit along the lower levels of the dam section where the hydrostatic pressures would be the highest. A partial cutoff through the terrace deposits on the upper abutments is the expected requirement. Due to the favorable topography of the site, the depth of cutoff excavation would be shallow, despite the relatively thick terrace deposits on the abutments.

4. A buried pipe serving as an outlet structure could be adequately founded along the curving channel of the stream or along the lower abutments beneath the dam.

5. Topography favors the left abutment for the spillway location. This structure would be founded on the terrace deposits. A moderately deep upstream cutoff will be required and the entire spillway channel would have to be lined to prevent erosion of the unconsolidated deposits.

6. An adequate quantity of suitable impervious earthfill materials appears to be available within the reservoir site. Sand and gravel for filters and aggregate and riprap materials appear to be lacking in the site area. These would have to be obtained from local commercial sources. The use of soil-cement for the upstream embankment face should be considered.

Hydrologic Studies

1. Based on hydrologic studies of a reconnaissance nature in conjunction with a reservoir volume of 2400 acre feet, the percolation yield (all stored water used each year) is approximately 2100 acre feet/year. The firm yield (assuming carryover storage from year to year) is approximately 1200 acre feet. The 100-year frequency peak design flow is 4900 cfs and the 200-year frequency design flow is 6000 cfs.

2. Flood hydrographs and reservoir routings were not utilized in this preliminary study. Stream gage data on Little Arthur Creek is available from about 1965. While this is too short a record to base an entire study on, it can be used in

conjunction with other techniques such as computer model stream flow simulation.

3. The area and storage elevation curves were derived from small scale (1"=200') USGS maps and therefore are approximate only.

4. Studies currently underway, primarily in regard to improvements of the mean annual precipitation maps, indicate a trend toward reduced peak flows and yields from watersheds in the vicinity of this site.

Design and Cost Studies

1. The damsite was mapped using photogrammetric technique. Where heavy vegetation did not occur, standard map accuracy was obtained. Under heavy vegetation the contours are general only.

2. A rough design of the dam and appurtenances was made. This design followed the recommendations of the geologic study and general dam construction practices and was primarily for cost estimating purposes. The design utilized for this cost summary is shown on Plates 1 through 3. Based on this preliminary design a cost of $2,476,500 was calculated including land, clearing and construction. Unit costs were estimated in 1972 dollars.

Suggestions for Future Studies

Although the present investigation could be considered adequate for an advanced reconnaissance study, an expanded investigation would be required to carry the exploration through feasibility and predesign phases. The objective of the expanded investigation would be to develop specific data for use in definitive design.

Some of the specific areas of the expanded investigation involve additional geologic exploration and hydrologic analysis. This work should include:

1. The determination of the depth of terrace deposits along the length of the damsite axis on both abutments by drilling additional holes. Borehole percolation tests should be performed in order to evaluate the permeability characteristics of the terrace deposits.

2. Determination of the foundation character and cutoff requirement should be performed beneath the spillway weir site.

3. Determination of the available volume and quality of the potential impervious earthfill borrow materials within the reservoir site. This could be accomplished by the drilling and sampling of auger holes and performing soils laboratory testing of samples.

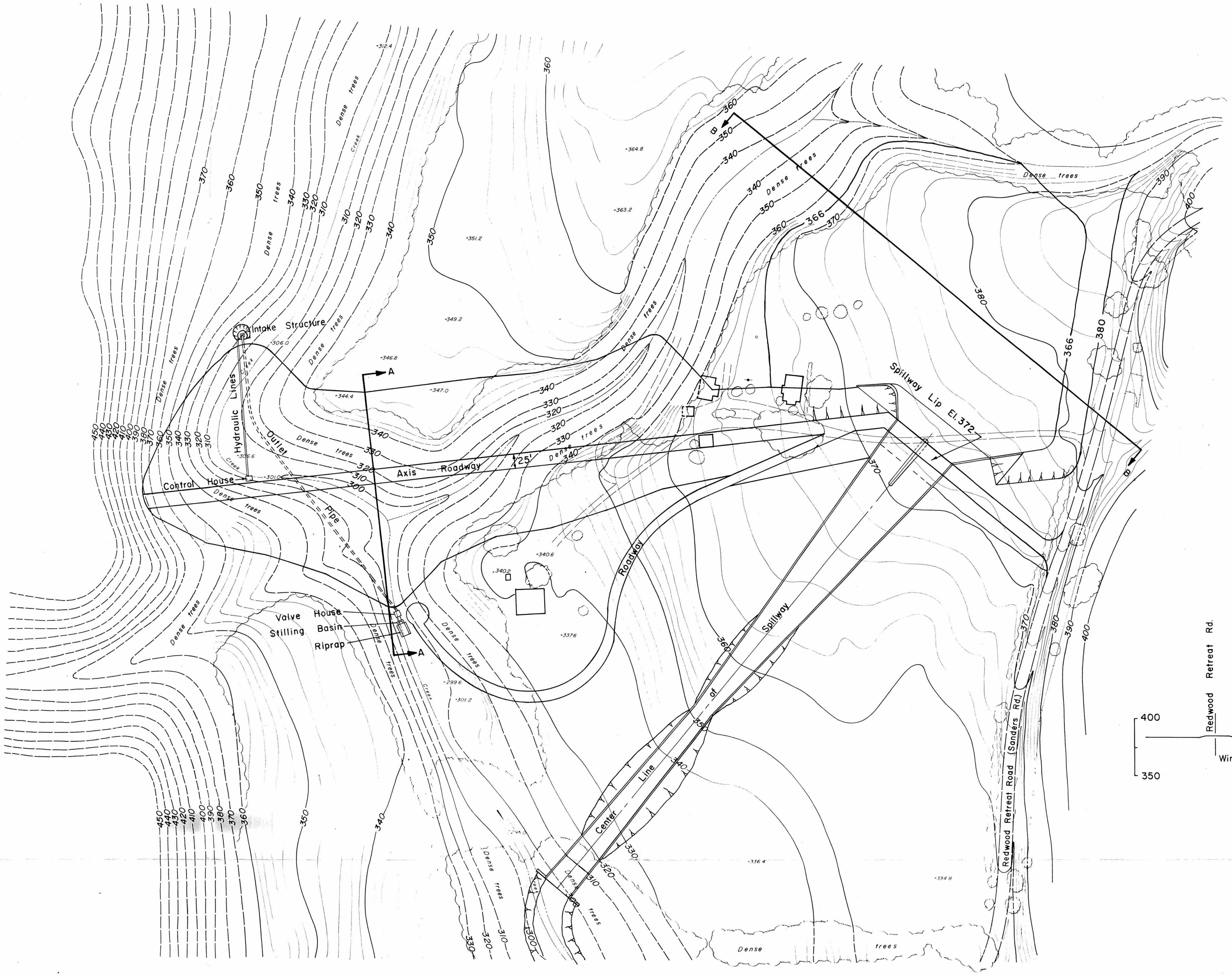
4. If local sources of riprap are considered, the potential quarry site located 3/4 mile upstream would have to be proven by diamond core drilling. Samples should be obtained and lab-

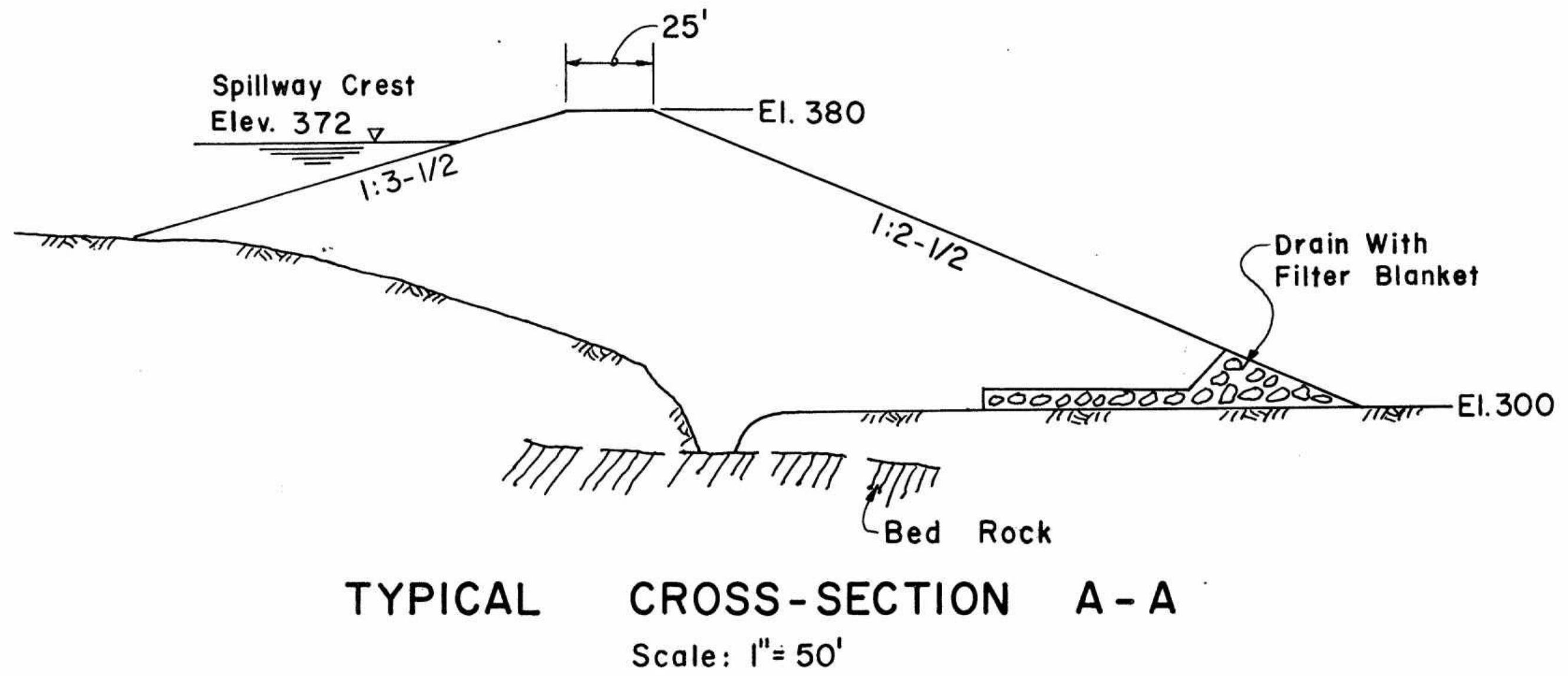
oratory tested for durability and chemical soundness (resistance to weathering).

5. Complete topographic mapping of the reserovir area should be undertaken.

6. Flood Hydrographs for the watershed should be developed and routed through the reservoir to determine accurate spillway design. The latest information as to the hydrologic responses of the watershed and reservoir should be utilized including the existing stream gage at Redwood Retreat Road.

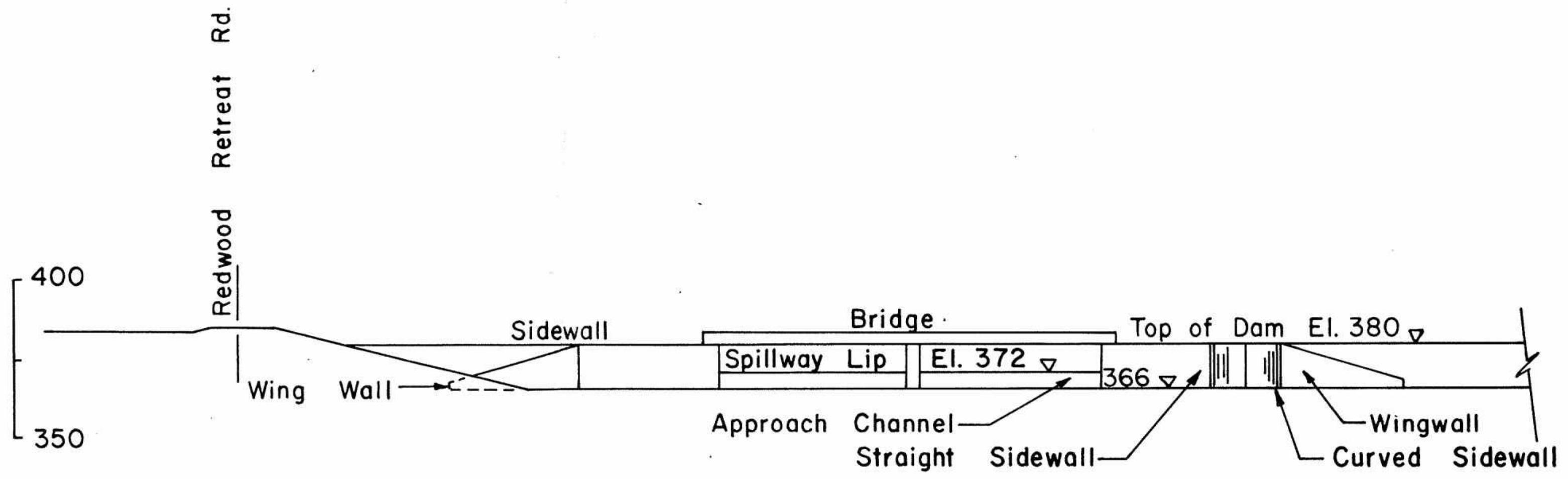
From the expanded analyses, overall benefits could be derived and compared to estimated costs to determine overall economic feasibility of the project. If the economic feasibility is favorable or even slightly negative, additional geologic and engineering studies should be undertaken to refine the design and proceed with the project.





TYPICAL CROSS-SECTION A-A

Scale: 1" = 50'



SECTION ALONG B-B

Scale: 1" = 50'

REFER TO TRACING FOR LATEST REVISION				REFERENCE INFORMATION AND NOTES				
REV	DESCRIPTION	SUB	APPR		DATE	SANTA CLARA COUNTY FLOOD CONTROL AND WATER DISTRICT	PLAN VIEW - DAM SITE LITTLE ARTHUR CREEK	SCALE As Shown
					DESIGN			SHEET
					DRAWN S.K.A	PREPARED FOR SOUTH SANTA CLARA VALLEY WATER CONSERVATION DISTRICT		
					CHECKED			

PLATE 2

REFER TO TRACING FOR LATEST REVISION

REV.	DESCRIPTION	SUB.	APPR.

REFERENCE INFORMATION AND NOTES

DATE

DESIGN J. P.

DRAWN F. WEILAND

CHECKED

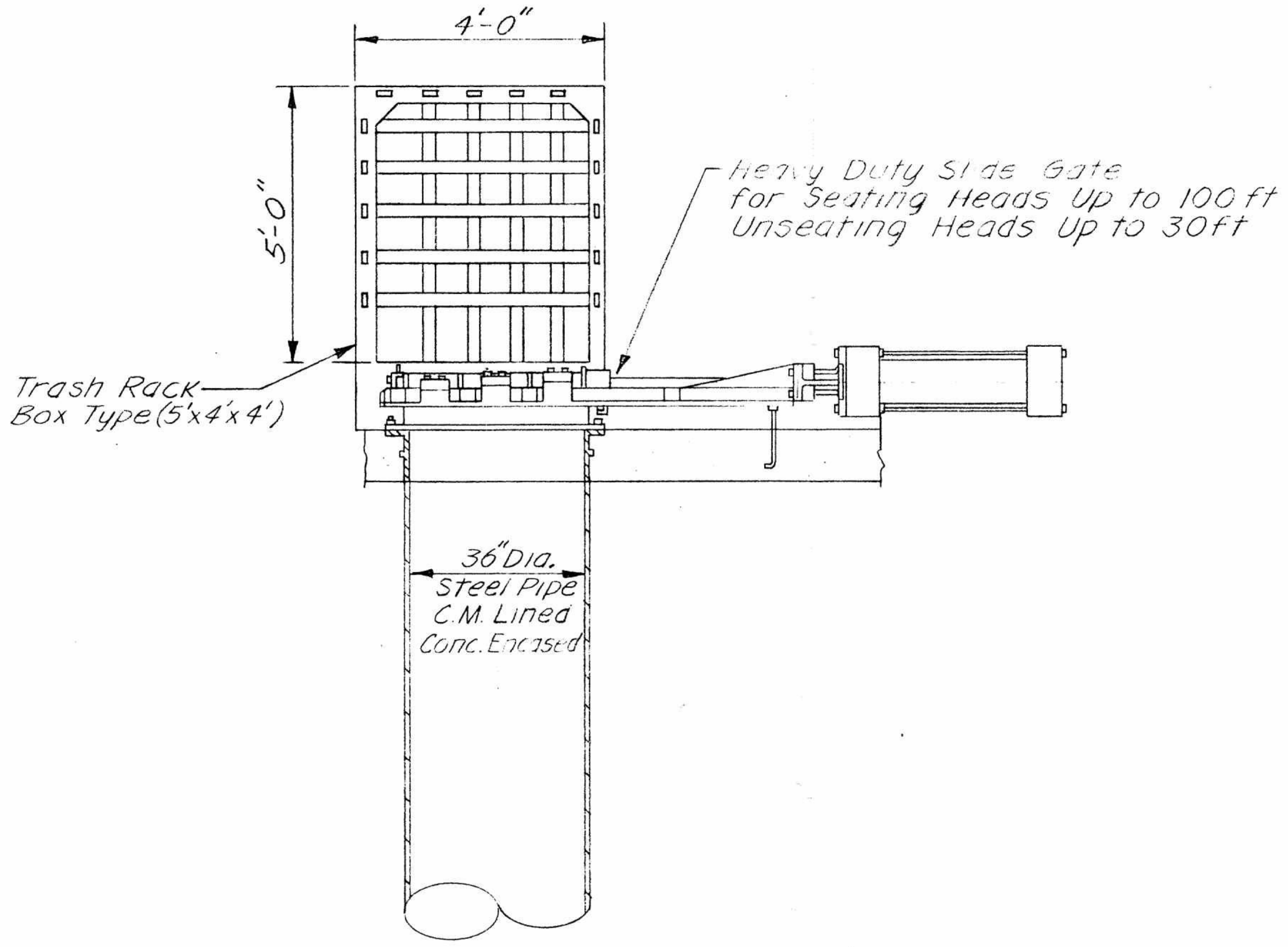
SANTA CLARA COUNTY FLOOD CONTROL
AND
WATER DISTRICT
PREPARED FOR
SOUTH SANTA CLARA VALLEY WATER
CONSERVATION DISTRICT

SPILLWAY — DAM SITE
LITTLE ARTHUR CREEK

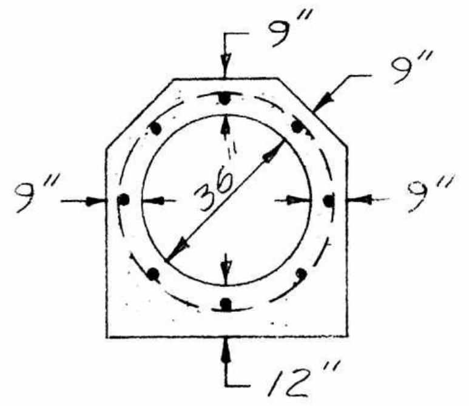
SCALE
As Shown

SHEET

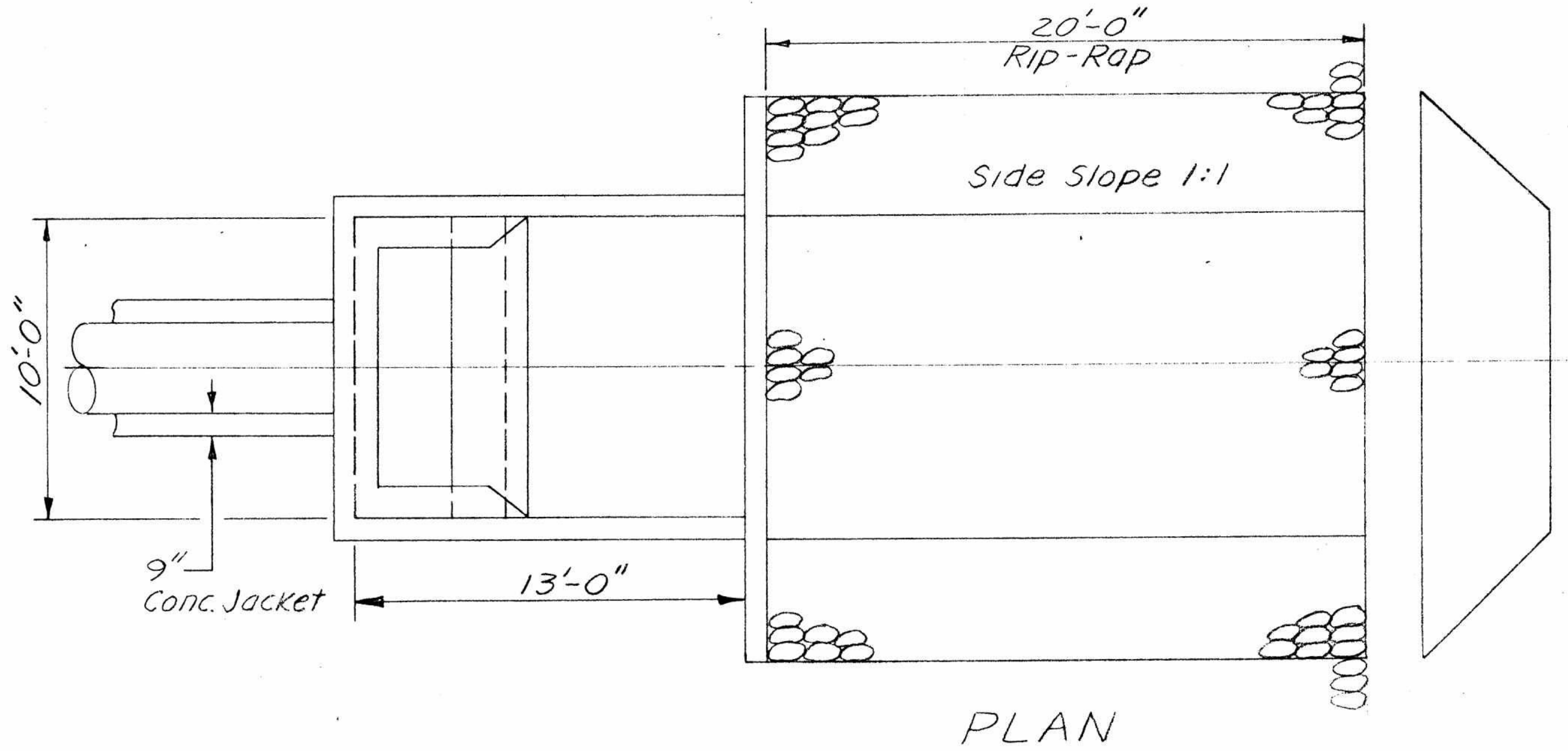
PLATE 3


4'-0"
5'-0"
Heavy Duty Slide Gate for Seating Heads Up to 100 ft Unseating Heads Up to 30 ft
Trash Rack Box Type (5'x4'x4')
36" Dia. Steel Pipe C.M. Lined Conc. Encased

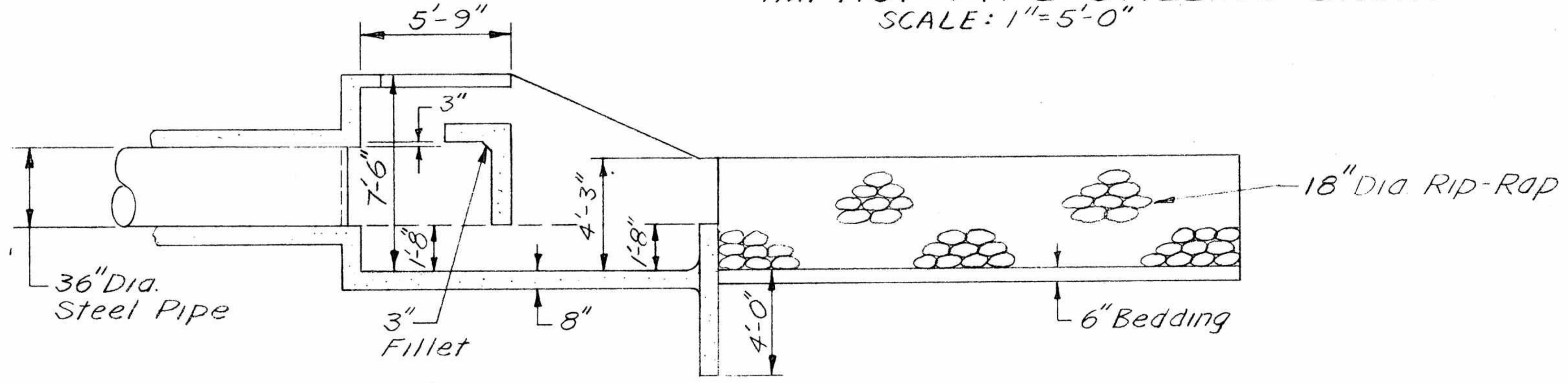
INTAKE DETAIL
NO SCALE



SECTION Ⓐ
Scale: 1"=4'-0"



PLAN
IMPACT TYPE STILLING BASIN
SCALE: 1"=5'-0"



SECTION
IMPACT TYPE STILLING BASIN
Scale: 1"=5'-0"

400
380
360
340
320
300
280
260
Intake Gate Operating Vault
Hydraulic Lines for Gate Operation
Trash Rack Inv. El. 319
Slide Gate (Horizontal Operation)
Ground Level
Intake Structure
A
A
S=0.005
36" Dia. Steel Pipe, Concrete Encased, C.M. Lined
36" Butterfly Valve Manually Operated
18" Rip-Rap
Valve House
20'
Pipe Invert El. 295
IMPACT TYPE STILLING BASIN
0
20
40
100
200
300
400
500
560
600
Distance (Ft)

SECTION ALONG OUTLET PIPE
Scale: 1"=20'-0"

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DATE	
DESIGN	HM
DRAWN	GEP
CHECKED	

SANTA CLARA COUNTY FLOOD CONTROL
AND
WATER DISTRICT
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SOUTH SANTA CLARA VALLEY WATER
CONSERVATION DISTRICT

OUTLET WORKS
LITTLE ARTHUR CREEK DAM

SCALE
AS SHOWN

SHEET